



Backflow Prevention Assemblies & Devices

Preventing Cross-Connections

The Plan Review & Construction Program of the Maricopa County Services Department has developed this handout to protect potable water from backflow and cross-connections. Backflow (backpressure or back-siphonage) is the potentially dangerous reversal of the flow of water from its intended direction in any pipe or plumbing system. A cross-connection can be a temporary or permanent connection or arrangement of plumbing between potential sources of known or unknown pollution and/or contaminants and a potable water supply through which backflow could occur. Approved backflow protection measures must be provided to prevent a potable water supply from being compromised through a reversal of water flow. In order to ensure safe potable water, all permitted establishments are responsible for providing adequate backflow protection. A properly installed, tested and maintained backflow preventer can reliably protect a potable water system.

The Environmental Services Department requires that all plumbing must meet the 2009 International Plumbing Code requirements (2009 IPC). Be advised that an establishment located within an unincorporated area of Maricopa County must meet the requirements of the 2012 IPC. Local jurisdictions, local cross-connection control programs as well as our Department enforce plumbing regulations that prevent cross-connection hazards from occurring. All plumbing, connections, including chemical dispensing systems that provide a means of mixing potable water with chemicals to provide a user with a chemical solution which is ready for use must be in compliance with current codes, manufacturer design specifications, and Department requirements.

A plumbing system must be installed according to law and maintained in good repair. One critical part of the plumbing system is an anti-siphon valve or backflow prevention device or assembly. A backflow prevention device or assembly must meet American Society of Sanitary Engineering standards (ASSE). Also, the backflow prevention device or assembly must be accessible for inspection and servicing. The backflow prevention device or assembly must be installed when required to prevent cross-connections. A plumbing system must be installed to preclude backflow of a solid, liquid or gas contaminant into the water supply system. Direct connections must not exist between a sewage system and a drain originating from equipment in which food, equipment and or utensils are placed. The backflow prevention devices or assemblies that are normally approved for various applications are presented in this handout. The pollutants and/or contaminants of a cross-connected plumbing system could flow back into the potable water supply. Without the appropriate protection, something could pollute/contaminate the potable water.

This handout helps with understanding the different devices and assemblies that can be utilized to protect the potable water supply system from becoming polluted/contaminated. It is the shared responsibility of customers, permitted establishments, and the Maricopa County Environmental Services Department that all permitted establishments meet minimum backflow prevention requirements in order to ensure that the consumer is safe and to prevent backflow from occurring in potable water supplies. This shared responsibility extends to ensuring that consumer expectations are met that an establishment's potable water supply is safe to the public and citizens of Maricopa County.

Currently, there are many brands and types of commercially acceptable backflow preventers available to select from in the marketplace in order to provide adequate protection. Backflow prevention assemblies/devices are listed by manufacturer's name, type of assembly/device, model size, listed approvals, and intended applications. At this time, the following acceptable types of backflow prevention devices and assemblies are approved by the Department to achieve potable water supply protection from potential cross-connections.

For additional information please contact the Department's Plan Review & Construction Program at 602-506-6980, or by e-mail at esd.maricopa.gov, or contact your local jurisdiction's cross-connection control specialist.



Post-Mix Carbonated Beverage Systems

If an establishment installs post-mix carbonated beverage equipment (i.e. soda tower), an approved backflow preventer must be provided to prevent carbonic acid (H_2CO_3) from coming into contact with copper and copper alloy pipes and fittings. The carbonation in soda is formed when carbon dioxide gas (CO_2) mixes with water to form carbonic acid. Carbonic acid is highly corrosive to copper and copper alloys and chemically dissolves copper from lines creating an excess of copper in the water. A person consuming the copper-carbonate solution may become seriously ill with copper poisoning. *Please refer to Figure-1.*

There are two backflow prevention methods approved by this Department for post-mix carbonated beverage installations:

- a. **Reduced Pressure Principle Zone Assembly (RPZ).** An RPZ is a testable backflow prevention assembly designed for continuous pressure applications and the prevention of health hazard cross-connections. These assemblies are designed to protect potable water supplies in accordance with plumbing codes and local water authority requirements by providing maximum protection against backflow caused by either backpressure or backsiphonage in health hazard installations. A RPZ must be installed at each potential health hazard location to prevent backflow due to backsiphonage and/or backpressure. The assemblies must be properly installed between the water supply line and the carbonator. The line that connects the RPZ and the carbonator must be constructed of a food grade hose/piping that is approved for such use. The use of any copper or copper alloy connection downstream of the RPZ valve is prohibited. A funnel/hub drain with a rigid drain line must be installed under the relief port and drained to an approved receptacle, such as a floor sink. RPZ's are designed with test cocks and are required by code to be tested annually to ensure they are operating correctly. Cast bronze backflow preventers are acceptable by this Department, although certain jurisdictions may require the installation of stainless steel backflow preventers. The backflow preventer must be installed with sufficient side and top clearance to provide adequate space for testing and maintenance of the unit. The backflow preventer must be installed at least 12-inches above a floor sink. The assemblies must be tested annually by a certified backflow tester for proper operation. Copies of the annual backflow preventer test certification records of service maintenance must be maintained onsite by the owner/operator for verification by a Department representative. RPZ assemblies are the recommended method of backflow prevention because of the high level of protection provided and the long term ease of maintenance.

Example of a RPZ Assembly



For health hazard cross-connections and continuous pressure applications. Testable.

- b. **ASSE 1022 Dual Check Valves.** Any dual check valve device with atmospheric vent that meets ASSE 1022 standards are approved for carbonated beverage systems. These non-testable devices are typically installed directly to the carbonator at the water inlet connection. These devices also have a relief port and a drain line must be routed from these ports to an approved receptacle, such as a floor sink. These units are non-testable, so if these devices are used, the business operator must have the device(s) inspected annually and provide an inspection report from a commercial beverage system installer, licensed plumber, or certified backflow tester, stating the backflow preventer is operable or that it is not malfunctioning, or replace the double check valve(s) annually. Annual inspection records of service maintenance must be kept onsite for verification by a Department representative.

Examples of ASSE 1022 Dual Check Valve Devices with Atmospheric Vent



Dual check backflow preventer for carbonated beverage machines. Intermittent or continuous pressure conditions. Non-testable.



Double Check Valve Assemblies

Double check valve assemblies are designed to protect potable water supplies from non-health hazard cross-connections and continuous pressure applications (i.e. Fire lines, misting systems, landscaping, irrigation, processing equipment, etc.). The approved use and installation of these assemblies must only be allowed for cross-connections identified by an inspector as non-health hazard.

Example of a Double Check Valve Assembly



For non-health hazard cross-connections and continuous pressure applications. Testable.

Atmospheric Vacuum Breakers (AVB)

Non-testable anti-siphon vacuum breaker devices are designed to protect potable water supplies from the backsiphonage of non-health hazard cross-connections and low flow, non-continuous pressure installations. Use only with non-continuous pressure (pressurized a maximum of 12 out of 24 hours). Not to be used where there is possibility that backpressure conditions may develop. No downstream shutoff valves are allowed. Must be installed at least 6-inches above the highest downstream piping or hose.

Example of an AVB Device



For non-health hazard cross-connection applications not subject to continuous pressure. Non-testable.

Pressure Vacuum Breakers (PVB)

Testable anti-siphon vacuum breaker assemblies are designed to protect potable water supplies from the backsiphonage of health hazard cross-connections subject to continuous pressure applications. Not designed to protect against backpressure conditions or water hammer shock. Must be installed at least 12-inches above the highest point of downstream piping.

Example of a PVB Assembly



For health hazard cross-connections and continuous pressure applications. Testable.

Hose Connection Vacuum Breakers

Hose connection vacuum breaker devices are designed for residential and industrial threaded hose applications to protect potable water supplies from the backsiphonage of health hazards installations. These devices must not be used under continuous pressure applications or where there is a possibility that a backpressure condition could develop.

Example of a Hose Connection Vacuum Breaker Device



For health hazard applications not subject to continuous pressure. Non-Testable.



Specialty Backflow Preventers with Intermediate Atmospheric Vent

Dual check valves designed for continuous pressure applications to protect potable water supplies from the backsiphonage of non-health hazards installations. The approved use and installation of specialty backflow preventers must only be allowed for cross-connections identified by an inspector as non-health hazards.

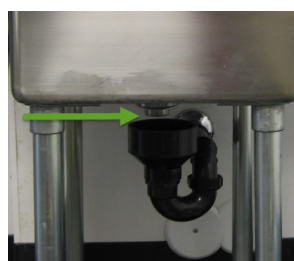
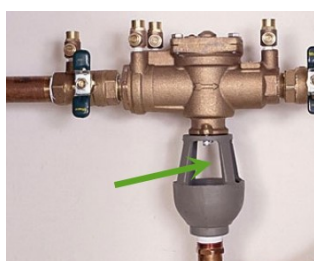
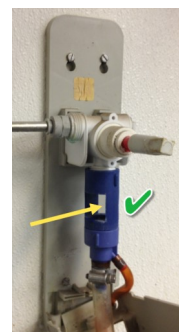
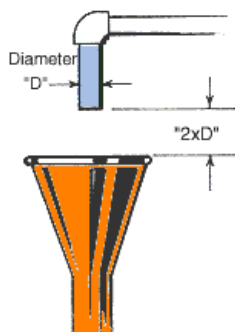
Examples of Specialty Backflow Preventers with Intermediate Atmospheric Vent



For non-health hazard applications in small pipe sizes subject to continuous pressure applications.

Air Gaps

An air gap is a physical separation between the free flowing discharge end of a potable pipe line and an open or non-pressure receiving vessel. To have an acceptable air gap, the end of the discharge pipe has to be at least twice the diameter of the pipe above the topmost rim of the receiving vessel, but in no case can this distance be less than 1-inch. This can often be the simplest, most effective and least expensive type of protection.



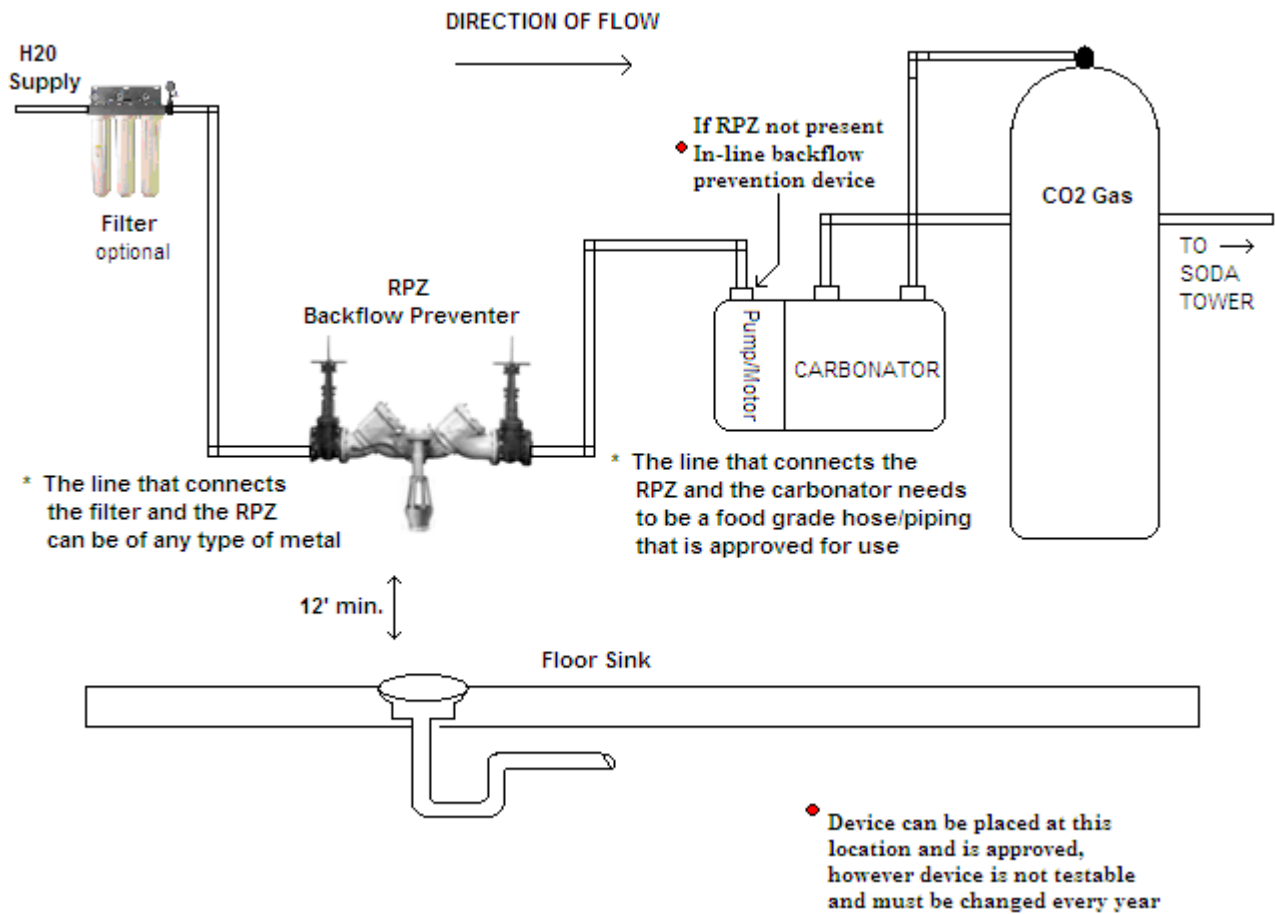
Notice:

- All plumbing must meet 2009 IPC (International Plumbing Code requirements) and current Maricopa County Environmental Services Department (MCESD) requirements.
- Approved backflow preventers must be provided for cross-connections as identified by a Department representative.
- All backflow prevention devices and assemblies must be rated for commercial applications and properly installed in accordance with the manufacturer's instructions and comply with all codes and standards, where applicable. Provide adequate space for inspection, servicing or testing.
- Downstream plumbing must be constructed of approved plastic or stainless steel. The piping and fittings between the backflow preventer and the carbonator must be approved plastic (approved plastic flex line) or stainless steel. Do not use copper, brass or copper alloys on the downstream side. Unnecessary downstream shut-off or check valves that place additional continuous pressure must not be placed on the downstream side of the backflow preventer.
- Funnel/hub drains, air gaps, p-traps, and rigid drain lines off backflow prevention assemblies must be provided where required.
- All drain lines must properly drain to an approved waste receptacle.
- Install water filters on the upstream (water supply side) of the backflow preventer.
- Proper air gaps must be provided and maintained where required.
- Backflow prevention assemblies and devices must be properly installed. Ensure the assembly/device installation allows for easy access.
- A certified tester must test or repair the assembly or inspect the device for proper operation before the Department will issue final approval to the establishment.
- Backflow prevention assemblies must be tested annually by a certified backflow tester for proper operation. All repairs are performed by certified backflow testers only. Copies of the annual (from one year of test/repair date) backflow preventer test certification/inspection/repair records of service maintenance must be maintained onsite by the owner/operator for verification by a Department representative.
- At the conclusion of a backflow preventer test or inspection, the tester should immediately tag the assembly/device and provide the result certification documentation to the establishment.
- An inspection of the establishment with adequate backflow protection in place and operating will be necessary to determine if it complies with the Maricopa County Environmental Health Code governing establishments. *Please refer to the Backflow Prevention Assembly/ Device – Inspection Checklist included in this handout.*
- This handout reflects accepted designs, applications, and considerations for implementing cross-connection control measures, standards, codes, and policies set forth by International Plumbing Code, EPA Cross Connection Control Manual, USC Foundation for Cross Connection Control and Hydraulic Research, American Water Works Association, ASSE, IAPMO, American Backflow Prevention Association, Arizona Backflow Prevention Association, local cross-connection jurisdictions, and Maricopa County Environmental Services Department.



Figure 1.

Carbonated Beverage Dispensing Systems “Soda Tower or Carbonated Beverage Connection”



BACKFLOW PREVENTION ASSEMBLY/DEVICE REQUIRED – Inspection Checklist

☐ **Reduced Pressure Principle Zone Assembly (RPZ)**



For health hazard cross-connections and continuous pressure applications. Air gap required. Testable.

☐ **ASSE 1022 Dual Check Valve**



Dual check backflow preventer for carbonated beverage machines. Intermittent or continuous pressure conditions. Non-testable.

☐ **Double Check Valve Assembly**



For non-health hazard cross-connections and continuous pressure applications. Testable.

☐ **Atmospheric Vacuum Breaker (AVB)**



For non-health hazard cross-connection applications not subject to continuous pressure. Non-testable.

☐ **Pressure Vacuum Breaker (PVB)**



For health hazard cross-connections and continuous pressure applications. Testable.

☐ **Hose Connection Vacuum Breaker**



For health hazard applications not subject to continuous pressure. Non-Testable.

☐ **Specialty Backflow Preventer with Intermediate Atmospheric Vent**



For non-health hazard applications in small pipe sizes subject to continuous pressure applications. Commercial system containment.